A NEW *CYMBOPETALUM* (ANNONACEAE) FROM COSTA RICA AND PANAMA WITH OBSERVATIONS ON NATURAL HYBRIDIZATION[1]

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ABSTRACT

Cymbopetalum torulosum G. E. Schatz, sp. nov., known from northeastern Costa Rica and a single location in Pacific western Panama adjacent to the Costa Rica border, is distinguished from the sympatric *C. costaricense* (Donn. Sm.) R. E. Fries by its strongly torulose monocarps. Populations at the La Selva Biological Station of the Organization for Tropical Studies are found on recent alluvial soils. They flower from February to August, are pollinated by the dynastine beetle *Cyclocephala sparsa* Arrow, and are dispersed by ochre-bellied flycatchers (*Mionectes oleaginea*). The species hybridizes with *C. costaricense.*

Se describe y se illustre una especie nueva de *Cymbopetalum* del nordeste de Costa Rica y de una sola localidad en Panamá, cerca de la frontera con Costa Rica al lado del Pacífico. Es muy fácil de distinguir *C. torulosum* de la especie sympátrica *C. costaricense* por medio de los monocarpos torulosos. Populaciones en la Estacíon Biología La Selva de la Organizacíon de Estudios Tropicales se encuentran en suelos recientes alluviales. Ellos florecen de Febrero hasta Agosto, estan polinizadas por el coleóptero *Cyclocephala sparsa* y estan dispersadas por el pájaro *Mionectes oleaginea.* La especie hybride con *C. costaricense.*

Cymbopetalum Bentham is one of the best circumscribed and most easily recognized genera of neotropical Annonaceae. It is characterized by the inner whorl of thick, fleshy, saccate petals. When last revised (Fries, 1931), the genus consisted of nine species ranging from Mexico to Brazil. Since that time, six additional species have been described (Schery, 1941; Fries, 1952, 1956; Lundell, 1974a, 1974b). Another distinctive species has now been discovered at La Selva Biological Station of the Organization for Tropical Studies.

Cymbopetalum torulosum G. E. Schatz, sp. nov.

TYPE: Costa Rica. Heredia: La Selva Biological Station, at the confluence of the Río Puerto Viejo and Río Sarapiquí, 3 km S of the town of Puerto Viejo de Sarapiquí, 10°26′N, 84°00′W, 35 m, 19 July 1984 (fl, fr), *Schatz & Grayum 1029* (holotype, MO; isotypes, CR, DUKE, NY, WIS.

Arbor parva usque ad 5 m alta, ramulis novellis tomentellis cinerascentibus. Folia brevipetiolata, petiolo applanato tomentello, lamina membranacea bullata, elliptica-oblonga ad obovata, 15–22 cm longa, 5–9 cm lata, apice acuminato ad caudato, basi inaequilatera rotundata ad cuneata, nervis lateralibus utrinque 17–22. Flores solitarii, penduli, supra-axillares; pedicelli tomentelli, 2–4 cm longi; sepala flavescentia, late ovata, 4–6 mm longa, 5–8 mm lata, apiculata, tomentella; petala exteriora flavescentia, plana, tenuia, late ovata, 19 mm longa, 16–19 mm lata, apiculata, tomentella, intus reticulata; petala interiora flavovirentia, crasse carnosa, cymbiformia, late ovata ad rotundata, 26–36 mm longa, 17–24 mm lata, extus sulcata. Stamina numerosa, 3.5–3.8 mm longa, filamentis 0.4 mm longis, connectivis minute papillatis. Carpella 8–24, 3 mm longa, stigmatibus connatis; ovula 8–12. Fructus apocarpus, monocarpiis usque ad 24, torulosis, 9 cm longis, apicibus acutis, stipitibus 10–15 mm longis.

Small trees to 5 m tall and 4 cm diam. at breast height. Young branches minutely gray-tomentose. Leaves alternate, short-petiolate, the petioles 2–3 mm long, flattened, tomentulose; leaf blade membranaceous, conspicuously bullate when fresh, grayish green with a slight sheen, elliptic-oblong to obovate, 15–22 cm long, 5–9 cm wide, the apex long acuminate to caudate, the base slightly inaequilateral, rounded to cu-

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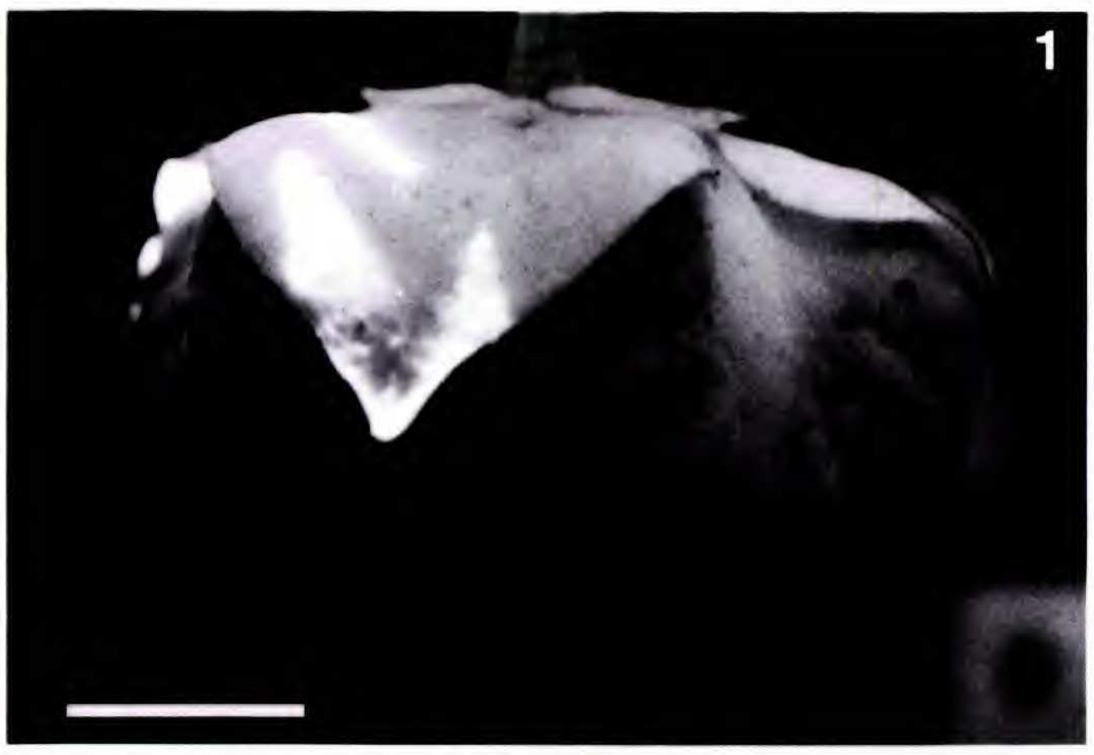
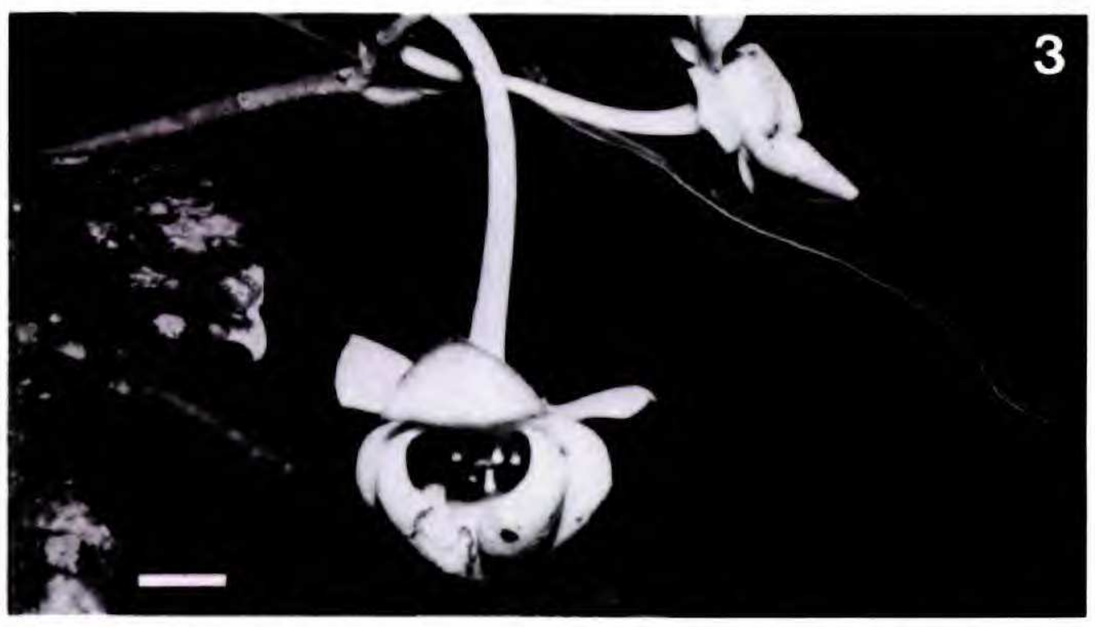
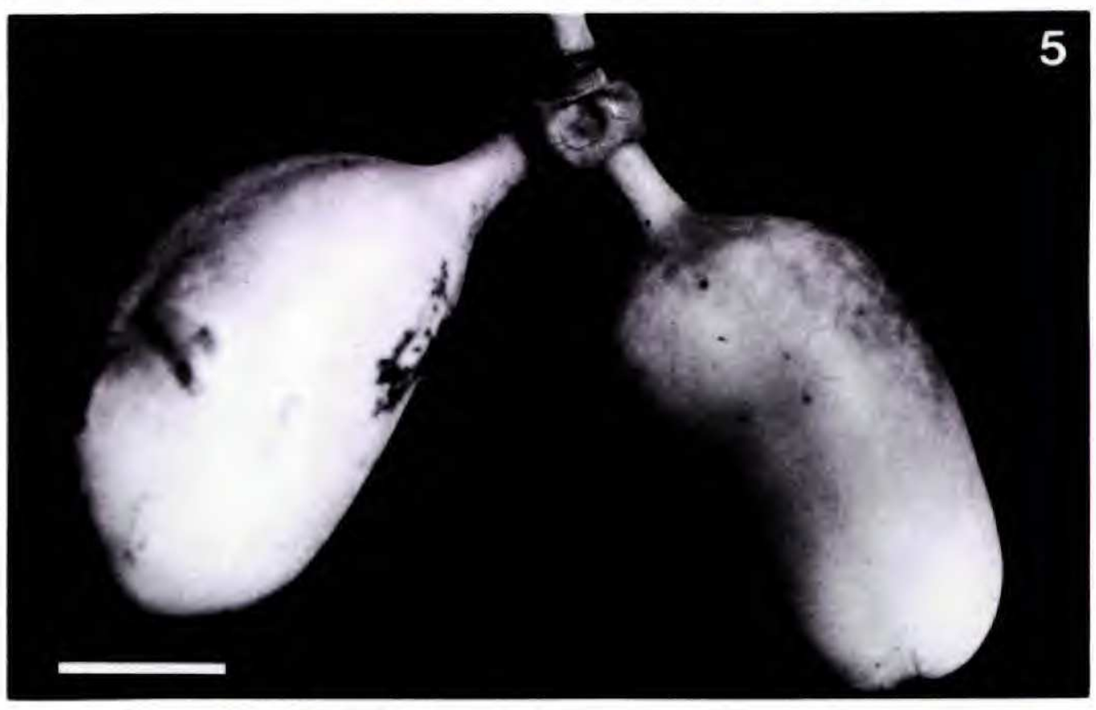




FIGURES 1–3. Flowers of Costa Rican *Cymbopetalum*.—1. *C. torulosum* at the end of female receptivity or the beginning of anther dehiscence (note closed outer petals).—2. *C. torulosum* during early female receptivity (note grooves and exudate on the stigmata). The pollinator, *Cyclocephala sparsa* Arrow (Scarabaeidae: Dynastinae), feeds at the base of one of the fleshy, inner petals.—3. *C. costaricense* during late anther dehiscence (note reflexed outer petals). Scale bar = 1 cm.



FIGURES 4–6. Fruits of Costa Rican *Cymbopetalum*.—4. *C. torulosum*.—5. *C. costaricense*.—6. Putative *C. torulosum* × *C. costaricense* hybrid (note the acute apex). Scale bar = 2 cm.

neate, the midrib sericeous on both surfaces, especially toward the base, elevated beneath, the 17–22 pairs of major lateral veins slender and strongly impressed. Flowers protogynous, actinomorphic, solitary, pendulous, supra-axillary, the pedicels rigid, minutely tomentose, especially at the base, 2–4 cm long; sepals 3, rarely 4, broadly ovate, 4–6 mm long, 5–8 mm wide, apiculate, minutely tomentose; petals 6, rarely 8, in two strongly differentiated whorls: outer petals closed down at anther dehiscence, appressed to inner petals, green initially, turning yellow at the end of female receptivity, thin, broadly ovate, 19 mm long, 16–19 mm wide, minutely tomentose, the apex acute, apiculate, the inner surface slightly reticulate; inner petals yellowish green, thick, fleshy, cymbiform, broadly ovate to rounded, 26–36 mm long, 17–24 mm wide, minutely tomentose, the margins strongly involute, 2 mm wide, the apex acute, the outer surface strongly sulcate, the inner surface only slightly striated. Stamens numerous, 3.5–3.8 mm long, the filaments 0.4 mm long, the anthers 3.1–3.4 mm long, the connectives minutely papillate. Carpels (8–)15–20 (–24), 3 mm long, the stigmata fused into a head which abscises as a unit just prior to anther dehiscence, the ovules 8–12 in a single row. Fruit

TABLE 1. Distinguishing characteristics of Costa Rican *Cymbopetalum*.

C. torulosum	*C. costaricense*
Young branches tomentulose	Young branches glabrous
Leaves elliptic-oblong to obovate, grayish green, with a slight sheen	Leaves elliptic, olive green, very glossy
Leaves with 17–22 pairs of major lateral veins, these strongly impressed, the lamina bullate	Leaves with 9–12 pairs of major lateral veins, these only slightly impressed, the lamina smooth
Flowers solitary, borne midway between nodes bearing full-sized leaves	Flowers borne on new "short-shoots," subtended by small bract-like leaves, thus clustered, and either leaf-opposed or pseudo-terminal
Calyx and corolla tomentulose	Calyx slightly tomentulose, corolla glabrate
Outer petels closed at anther dehiscence, appressed to inner petals	Outer petals usually strongly reflexed at anther dehiscence
Outer petals slightly reticulated on the inner surface	Outer petals strongly striated on the inner surface
Inner petals strongly sulcate on the outer surface, only slightly striated on the inner surface	Inner petals glabrous on the outer surface, striated on the inner surface
Monocarps torulose at maturity, the apex acute, with a single row of seeds	Monocarps not torulose at maturity, the apex rounded, with two rows of seeds

apocarpous, a cluster of up to 24 monocarps, the monocarps torulose, to 9 cm long (including stipes 1–1.5 cm long), opening along a suture which appears at maturity along the abaxial surface opposite the indehiscent carpellary suture; seeds black, ellipsoid, 12 mm long, 7 mm diam., with a thin orange aril (Figs. 1, 2, 4).

Distribution. *Cymbopetalum torulosum* is known from the Río San Juan drainage in northeastern Costa Rica, both from the Río Sarapiquí region and the Llanuras de San Carlos, and from a single specimen from lowland Chiriquí Province, Panamá, adjacent to the Costa Rican border along the Pacific coast, an area comparable in rainfall. It is also to be expected in southeastern Nicaragua, as yet a poorly collected area.

Ecology. At the La Selva Biological Station of the Organization for Tropical Studies, *Cymbopetalum torulosum* is restricted to the most recent alluvial soils bordering the Río Puerto Viejo, Río Sarapiquí, and Río Peje, and slightly

FIGURES 7, 8. Monocarps of Costa Rican *Cymbopetalum*. In each figure: left, *C. costaricense* with rounded apex; center, putative *C. torulosum* × *C. costaricense* hybrid with acute apex (note variable morphology of putative hybrid monocarps); right, *C. torulosum* with acute apex. Scale bar = 2 cm.

inland from the rivers along their tributaries and in low-lying swamps. It flowers over a long period from February to August, during the dry season and early part of the rainy season, with the peak of flowering occurring during April and May, and is pollinated by *Cyclocephala sparsa* Arrow (Scarabaeidae: Dynastinae), attracted to female phase flowers during the early evening hours by a subtle odor reminiscent of linseed oil (unpubl. data). Fruit takes six to seven months to mature before the carpels split open to reveal the orange-arillate seeds. Seeds of *C. torulosum* are dispersed by birds that feed upon the aril and either pass or regurgitate the seeds. Regurgitated *Cymbopetalum* seeds have been recovered from an ochre-bellied flycatcher (*Mionectes oleaginea*), an apparent specialist on arillate seeds (D. Levey, pers. comm.). Seeds germinate in approximately four weeks (unpubl. data).

Etymology. From the Latin *torulosus,* meaning cylindrical with constrictions at intervals, and referring to the strongly torulose monocarps, distinguishing them from monocarps of the sympatric *C. costaricense* (Donn. Sm.) R. E. Fries (Figs. 3, 5).

Specimens examined. COSTA RICA. HEREDIA: La Selva Biological Station, confluence of the Río Puerto Viejo and Río Sarapiquí, 10 May 1982 (fl), *Schatz 589* (WIS); 7 Apr. 1982 (fl), *Hammel 11607* (CR, DUKE, WIS); 16 July 1981 (fr), *Hammel 10990* (DUKE); 14–17 June 1968 (fl), *Burger & Stolze 5747* (F, NY); 26 Apr. 1973 (fl), *Burger & Gentry 9248* (F); 27 Apr. 1981 (fl), *Folsom 9879* (DUKE, WIS); 25 May 1982 (fl), *Hammel 12499* (DUKE, WIS); 23 Apr. 1982 (fl), *Hammel & Trainer 12753* (DUKE, WIS). ALAJUELA: near Caño Negro, 18–22 km N of Agua Zarcas in Llanuras de San Carlos (10°31′N, 84°24′W), 60 m, 21 May 1968 (fl), *Burger & Stolze 5200* (F). PANAMA. CHIRIQUÍ: Comarca del Baru, area W of Puerto Armuelles, 100 ft., 15 June 1957 (fl), *Stern & Chambers 127* (MAD).

There appears to be a natural subdivision within *Cymbopetalum* between torulose and nontorulose fruited species. *Cymbopetalum torulosum* is more closely related to the other torulose-fruited species than to the sympatric *C. costaricense,* from which it is easily distinguished (Table 1). Within the torulose-fruited group, *C. torulosum* seems to be most closely related to *C. tessmannii* R. E. Fries from Peru. It differs from *C. tessmannii* by having larger leaves with more major lateral veins, larger flowers, and more ovules per carpel.

Determination of Costa Rican *Cymbopetalum* becomes problematic in light of the discovery of hybridization between *C. torulosum* and *C. costaricense* at La Selva Biological Station. *Cymbopetalum torulosum* is restricted to the most recent alluvial soils; *C. costaricense* occurs on older alluvium and residual soils. Putative hybrid individuals have been located in a zone of overlap, where the most recent alluvium grades into older alluvium. Flowering phenology of the two species also differs at La Selva. Peak flowering of *C. torulosum* occurs during April and May, whereas that of *C. costaricense* occurs in July and August. Nevertheless, overall flowering periods of each species do overlap. *Cymbopetalum costaricense* is also pollinated by *Cyclocephala sparsa,* and marked individuals of *C. sparsa* have been observed to move from one species to another within a 24 hour period.

Putative hybrids are intermediate in both vegetative and reproductive characters, such as the amount of pubescence on young branches and the number of major lateral veins on leaves. The fruits of hybrids are particularly illustrative, the monocarps exhibiting two rows of seeds, one complete and the other incomplete, and always having an acute apex (Figs. 6–8). The morphology of hybrid fruits is variable, the monocarps often resembling more closely one or the other of the parental types (Figs. 7, 8).

Artificial interspecific crosses have yielded mature fruit and seed (unpubl. data). Seeds from the spontaneous putative hybrid fruit pictured in Figures 6 and 7 germinated successfully.

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